

Arizona Water Production and Consumption Analysis

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Abstract

As of March 2025, a staggering 99% of Arizona was in a state of drought (US Drought Monitor 2025). Decreases in precipitation in our state have brought about concerns for the future of Arizona's water future, and how the state is going to sustain their growing population and water consumption rates. This project analyzes water production and consumption data from the United States Geological Survey (USGS) to identify anomalies and investigate sectors exhibiting unusual water loss in Arizona. The data, collected from publicly available USGS resources includes information on water withdrawals, usage by sector, and sources such as surface and groundwater. The goal is to uncover patterns and discrepancies that may indicate inefficiencies or areas for improved water management. Additionally, this analysis explores the potential ethical and environmental benefits of increasing the use of reclaimed water within Arizona's water management strategy. By identifying opportunities to optimize water use and integrate sustainable practices, the project aims to support more informed decision-making for managing Arizona's limited water resources effectively.

Introduction.

For this project, we collected publicly available data from the United States Geological Survey (USGS) and the Arizona government website. The USGS Arizona water use dataset is updated every five years, with the most recent entry from 2015. This dataset includes information on water supply and demand across various sectors, such as public, domestic, agricultural, commercial, industrial, thermoelectric, irrigation, livestock, and wastewater. It also documents wastewater returned by these sectors. The data is gathered through a collaborative census involving local, state, and federal agencies, capturing around 277 variables during each collection cycle. Our interest in this data lies in its potential to reveal patterns, inefficiencies, and opportunities for improved water management in Arizona, a state facing significant water scarcity challenges.

Methods.

The "USGS Water Use Data for All of Arizona" didn't necessarily have easily accessible downloads. To collect this data, we relied on manual downloading and preprocessing steps, including reformatting and ensuring consistency across variables.

The analysis plan involves exploratory data analysis (EDA) to identify patterns and potential anomalies in water use across different sectors. We also intend to use regression analysis for potential predictors of water consumption. If advanced statistical modeling proves impractical, we will focus on comparative analysis between sectors and historical data to highlight significant shifts or inefficiencies in water use.

Expected Outcomes.

If everything goes as planned, we expect to identify patterns and anomalies in water use across various sectors in Arizona, such as unusually high losses or inefficiencies. Additionally, we anticipate uncovering

trends that highlight sectors with the greatest potential for water conservation. The analysis may also reveal the benefits of increasing the use of reclaimed water as part of a sustainable water management strategy. Ultimately, these findings could support more informed policy decisions aimed at optimizing water resources and mitigating the impacts of water scarcity in Arizona.

Group Considerations

It will be expected of both group members to contribute to every aspect of the project. It was noted to start that Jack will take on creating good visuals and Delila will start looking at the data through a statistical lens.

Example Data Table: Coconino and Maricopa County entries for 2 recordings

State.Name	County.Name	Year	public self-supply withdrawals groundwater Mgal/d	domestic per capita use gal/d
Arizona	Coconino County	2005	13.40	109
Arizona	Coconino County	2010	12.46	109
Arizona	Coconino County	2015	16.22	87
Arizona	Maricopa County	2005	223.93	152
Arizona	Maricopa County	2010	223.92	151
Arizona	Maricopa County	2015	189.35	131

This excerpt dataset contains water use information for Coconino and Maricopa Counties, Arizona, from 2005 to 2015, including public self-supply groundwater withdrawals (in million gallons per day, Mgal/d) and domestic per capita water use (in gallons per day, gal/d).

Coconino County:

Self-supply withdrawals showed a fluctuation, increasing from 13.40 Mgal/d in 2005 to 16.22 Mgal/d in 2015, with a slight decrease in 2010 to 12.46 Mgal/d. Domestic per capita use remained stable at 109 gal/d in 2005 and 2010, then dropped to 87 gal/d in 2015.

Maricopa County:

Self-supply withdrawals remained high, with a decrease from 223.93 Mgal/d in 2005 to 189.35 Mgal/d in 2015, though there was little change between 2005 and 2010 (223.92 Mgal/d). Domestic per capita use decreased over time from 152 gal/d in 2005 to 131 gal/d in 2015, with a slight decrease from 151 gal/d in 2010.

In summary, both counties show a decrease in domestic per capita water use, but Coconino County saw more variation in withdrawals, while Maricopa County had more consistent withdrawals with a noticeable decline in recent years.